WHAT IS CLAIMED IS:

1. An SPM system for making a modification to an object, the SPM system comprising:

an SPM probe for making a modification to the object;

a positioning system to position the SPM modification probe with respect to the object; and

a controller to control the positioning system such that (1) the modification of the object is made with the SPM probe and particulate material is removed from the object due to the modification, and (2) the SPM probe makes sweeping motions over the object to sweep the particulate material away.

2. An SPM system as recited in claim 1 further comprising:

inspection components to make an inspection of the modification;

the sweeping motions of the SPM probe sweeping the debris material away from where the modification was made so that the inspection components may inspect the modification without obstruction.

3. An SPM system as recited in claim 2 wherein:

the inspection components include a second SPM probe to make the inspection;

the positioning system positions the second SPM probe with respect to the object; and

the controller further controls the positioning system such that the inspection is made with the second SPM probe.

4. An SPM system as recited in claim 2 wherein:

the inspection components include the SPM probe; and

the controller further controls the positioning system such that the inspection is made with the SPM probe.

1. An SPM system comprising:

an SPM probe for making a modification to the object;

a positioning system to position the SPM modification probe with respect to the object; and

a controller to control the positioning system such that positioning of the SPM probe with respect to the object is made by driving the positioning system simultaneously in the X, Y, and Z dimensions.

2. An SPM system as recited in claim 1 wherein:

the SPM probe is used to make a modification to the object by performing a cut in or milling the object;

the controller controls the positioning system such that the modification of the object is made with the SPM probe by driving the positioning system simultaneously in the X, Y, and Z dimensions.

3. An SPM system as recited in claim 1 wherein the controller drives the positioning system simultaneously in the X, Y, and Z dimensions so that the motion of the SPM probe in making the modification is a series of 3-D vectors.

4. An SPM system as recited in claim 3 wherein the motion defines a 3-D vector, arc, curve, or surface.

1. A graphical user interface for rendering first measurement data and second meassurement data on a display, the first and second measurement data each comprising measurement data points that each include first and second coordinate values representing a positon in a plane, each of the data points of the first measurement data further including a measurement value representing a measurement of a first predefined measurement parameter, each of the data points of the second measurement data further including a measurement value representing a measurement of a second predefined measurement parameter, the graphical user interface comprising:

a surface image generator to generate first image data from the first measurement data and second image data from the second measurement data, the first image data representing a 3-D first surface image of a first surface that extends along the plane and is contoured based on the measurement values of the data points of the first measurement data, the second image data representing a 3-D second surface image of a second surface that extends along the plane and is contoured based on the measurement values of the data points of the second measurement data; and

an overlay image generator to generate overlay image data by overlaying the first and second image data, the overlay image data representing a 3-D overlay image of one of the first and second surfaces overlaid on the other one of the first and second surfaces, the overlay image being displayed by the display in response to the overlay image data.

2. A graphical user interface as recited in claim 1 wherein the first and second predefined measurement parameters are different.

3. A graphical user interface as recited in claim 1 wherein the first and second predefined measurement parameters are the same.

4. A graphical user interface as recited in claim 1 wherein the overlay image generator comprises a separate surfaces image generator to generate the overlay image data so that the overlay image comprises the second surface translucently overlayed on the first surface.

5. A graphical user interface as recited in claim 4 further comprising:

an overlay controller to generate an offset value in response to a command provided by a user with a user input device, the office value representing a selected amount of offset between the first and second surfaces; and

the separate surfaces image generator generating the overlay image data further in response to the offset value so that the first and second surfaces appear offset by the selected amount in the overlay image.

6. A graphical user interface as recited in claim 1 wherein the overlay image generator comprises a separate surfaces image generator to generate the overlay image data so that the overlay image comprises one of the first and second surfaces opaquely overlayed on the other one of the first and second surfaces.

7. A graphical user interface as recited in claim 6 further comprising:

an overlay controller to generate an offset value in response to a command provided by a user with a user input device, the office value representing a selected amount of offset between the first and second surfaces; and

the separate surfaces image generator generating the overlay image data further in response to the offset value so that the first and second surfaces appear offset by the selected amount in the overlay image.

8. A graphical user interface as recited in claim 1 wherein the overlay image generator comprises a contiguous surface image generator to generate the overlay image data so that the overlay image comprises a contiguous surface including first portions and second portions that are connected together, the first portions comprising the portions of the first surface that overlap the second surface and the second portions comprising the portions of the second surface that overlap the first surface.

9. A graphical user interface as recited in claim 8 further comprising:

an overlay controller to generate an offset value in response to a command provided by a user with a user input device, the offset value representing a selected amount of offset between the first and second surfaces;

the contiguous surface image generator generating the overlay image data further in response to the offset value so that the first and second surfaces are offset by the selected amount and the first and second portions of the contiguous surface are altered in response.

Claims to surface augmentation

1. A graphical user interface for rendering first measurement data and second meassurement data on a display, the first and second measurement data each comprising measurement data points that each include first and second coordinate values representing a positon in a plane, each of the data points of the first measurement data further including a measurement value representing a measurement of a first predefined measurement parameter, each of the data points of the second measurement data further including a measurement value representing a measurement of a second predefined measurement parameter, the graphical user interface comprising:

a surface image generator to generate base image data from the first measurement data, the base image data representing a 3-D surface image of a surface that extends along the plane and is contoured based on the measurement values of the data points of the first measurement data,

an augmentation data generator to generate augmentation data from the second measurement data, the augmentation data providing an augmentation of the surface based on the measurement values of the data points of the second measurement data;

an augmented image generator to generate augmented image data by augmenting the base image data with the augmentation data, the augmented image data representing a 3-D augmented image of the surface augmented by the augmentation.

2. A graphical user interface as recited in claim 1 wherein the augmentation data provides coloring of the surface.

3. A graphical user interface as recited in claim 1 wherein the augmentation data provides texturing of the surface.

Claims to embedded cursor method

1. A graphical user interface for rendering on a display a 3-D composite image of an object and a display tool embedded in the object, the graphical user interface comprising:

an object image generator to generate object image data that represents a 3-D object image of the object;

a dislay tool image generator to generate display tool image data based on the object image, the display tool image data representing a 3-D display tool image of the display tool; and

a composite image generator to generate composite image data by combining the display tool image data and the object image data so that the composite image data represents the composite image, the composite image being displayed by the display in response to the composite image data.

2. A graphical user interface as receited in claim 1 wherein the display tool image data is generated further in response to a command issued by a user with a user input device to adjustably locate the display tool in 3-D in the object in the composite image.

3. A graphical user interface as recited in claim 1 wherein the 3-D composite image of the object is of the volume of the object and the display tool is embedded in and positionable in the volume of the object.

4. A graphical user interface as recited in claim 1 wherein the 3-D composite image of the object is of the surface of the object and the display tool is embedded in and positionable in the surface of the object.

1. An SPM system for inspecting and modifying an object, the SPM system comprising:

SPM probes that include one or more inspection SPM probes and one or more modification SPM probes;

inspection components to inspect the object by making SPM measurements with the one or more SPM inspection probes and to generate inspection results from the SPM measurments; and

modification components to modify the object with the one or more modification SPM probes based on the inspection results.

2. An SPM system as recited in claim 1 that further comprises:

calibration structures;

the inspection components calibrate the one or more inspection SPM probes for making the SPM measurements with ones of the calibration structures;

the modification components calibrate the one or more modification SPM probes for modifying the object using ones of the calibration structures.

3. An SPM system as recited in claim 1 wherein:

the inspection components and the modification components each include a scanning head;

the inspection components selectively load and unload the one or more inspection SPM probes to and from the scanning head of the inspection components to make the SPM measurements; and

the modifcation subsystem selectively loads and unloads the one or more modification SPM probes to and from the scanning head of the modification components to make the modifications to the object.

4. An SPM system as recited in claim 3 wherein the scanning head of the modification components and the scanning head of the inspection components are the same scanning head.

5. An SPM system as recited in claim 3 wherein the scanning head of the modification components and the scanning head of the inspection components are different scanning heads.

6. An SPM system for inspecting and modifying an object, the SPM system comprising:

SPM probes that include one or more inspection SPM probes and one or more modification probes for modifying the object;

inspection means for inspecting the object by making SPM measurements with the one or more SPM inspection probes and generating inspection results from the SPM measurments; and

modification means for modifying the object with the one or more modification SPM probes based on the inspection results.

7. An SPM system as recited in claim 6 that further comprises:

calibration structures;

the inspection means calibrates the one or more inspection SPM probes for making the SPM measurements with ones of the calibration structures;

the modification means calibrates the one or more modification SPM probes for modifying the object using ones of the calibration structures.

8. An SPM system as recited in claim 6 wherein:

the inspection means and the modification means each include a scanning head;

the inspection means selectively loads and unloads the one or more inspection SPM probes to and from the scanning head of the inspection means to make the SPM measurements; and

the modifcation means selectively loads and unloads the one or more modification SPM probes to and from the scanning head of the modification means to make the modifications to the object.

9. An SPM system as recited in claim 8 wherein the scanning head of the modification components and the scanning head of the inspection components are the same scanning head.

10. An SPM system as recited in claim 8 wherein the scanning head of the modification means and the scanning head of the inspection means are different scanning heads.

11. A method for inspecting and modifying an object, the method comprising the steps of:

inspecting the object by making SPM measurements with one or more SPM inspection probes;

generating inspection results from the SPM measurments; and

modifying the object with one or more modification SPM probes based on the inspection results.

12. A method as recited in claim 11 that further comprises the steps of:

the inspection means calibrates the one or more inspection SPM probes for making the SPM measurements with ones of the calibration structures;

the modification means calibrates the one or more modification SPM probes for modifying the object using ones of the calibration structures.

13. A method as recited in claim 11 that further comprises the steps of:

selectively loading and unloading the one or more inspection SPM probes to and from a scanning head to make the SPM measurements; and

selectively loading and unloading the one or more modification SPM probes to and from a scanning head to make the modifications to the object.

14. A method as recited in claim 13 wherein the scanning head used in the modifying step and the scanning head used in the inspecting step are the same scanning head.

15. A method as recited in claim 13 wherein wherein the scanning head used in the modifying step and the scanning head used in the inspecting step are different scanning heads.

Claims to probe with base surrounding tip that is not activated below surface of base

16. An SPM probe that comprises:

an SPM tool with which to make the SPM measurements of or SPM modifications to an object; and

a base that has an upper and lower surface and is connected to and surrounds the SPM tool so that the SPM tool is located between the upper and lower surface and is thereby protected from being damaged.

17. An SPM probe as recited in claim 16 further comprising:

an additional SPM tool with which to make SPM measurements of or SPM modifications to an object;

the base being connected to and surrounding the additional SPM tool so that the SPM tool is located between the upper and lower surface.

18. An SPM system that comprises:

an SPM probe comprising:

an SPM tool; and

a base that has an upper and lower surface and is connected to and surrounds the SPM tool so that the SPM tool is located between the upper and lower surface and is thereby protected from being damaged; and

components to make SPM measurements of or SPM modifications to an object with the SPM tool.

19. An SPM system as recited in claim 18 wherein the SPM probe further comprises:

an additional SPM tool;

the base being connected to and surrounding the additional SPM tool so that the additional SPM tool is located between the upper and lower surface and is thereby protected from being damaged;

the components also making SPM measurements of or SPM modifications to an object with the additional SPM tool.

Claims to probe with base surrounding tip that is activated below surface of base

20. An SPM probe that comprises:

an SPM tool that has a cantilever and a tip on the cantilever; and

a base that has an upper and lower surfacer and surrounds the SPM tool;

the cantilever of the SPM tool being connected to the base so that the SPM tool is located between the upper and lower surface when the cantilever is not bending, the cantilever of the SPM tool being capable of being selectively bent back and forth by a tip activation apparatus so as to selectively position the tip of the SPM tool below and above the lower surface of the base whereby the tip of the SPM tool may be selectively activated and deactivated for making SPM measurements or SPM modifications to an object and protected from being damaged when deactivated.

21. An SPM probe as recited in claim 20 that further comprises the tip activation apparatus.

22. An SPM probe as recited in claim 21 wherein:

the cantilever is conductive;

the tip activation apparatus comprises electrodes fixed to the base above and below the cantilever;

whereby the canilever is selectively bent back and forth by applying selected voltages to the electrodes and the cantilever.

23. An SPM probe as receited in claim 20 further comprising:

an additional SPM tool having a cantilever and a tip on the cantilever; and

the cantilever of the additional SPM tool being connected to the base so that the additional SPM tool is located between the upper and lower surface when the cantilever is not bending, the cantilever of the additional SPM tool being capable of being selectively bent down and up by a tip activation apparatus so as to selectively position the tip of the additional SPM tool below and above the lower surface of the base whereby the tip of the additional SPM tool may be selectively activated and deactivated for making SPM measurements of or SPM modifications to an object and protected from being damaged when deactivated.

24. An SPM system that comprises:

an SPM probe that comprises:

an SPM tool that has a cantilever and a tip on the cantilever; and

a base that has an upper and lower surfacer and surrounds the SPM tool;

the cantilever of the SPM tool being connected to the base so that the SPM tool is located between the upper and lower surface when the cantilever is not bending;

a tip activation apparatus to selectively cause the cantilever of the SPM tool to be bent down and up so as to selectively position the tip of the SPM tool below and above the lower surface of the base whereby the tip of the SPM tool may be selectively activated for operation and deactivated for protection against being damaged;

components to make SPM measurements or SPM modifications to an object with the SPM tool when the tip of the SPM tool is activated.

25. An SPM probe as recited in claim 24 wherein:

the tip activation apparatus comprises a pivot, a lever arm that pivots on the pivot, and a lever arm movement mechanism;

whereby the canilever of the SPM tool is selectively bent down and up by causing the lever arm movement mechanism to selectively move a first end of the lever arm up and down so that the lever arm pivots on the pivot and a second end of the lever arm moves down and up while contacting the cantilever of the SPM tool.

26. An SPM system as recited in claim 24 wherein the SPM probe comprises the tip activation apparatus.

27. An SPM probe as recited in claim 26 wherein:

the cantilever is conductive;

the tip activation apparatus comprises electrodes fixed to the base above and below the cantilever;

whereby the canilever is selectively bent back and forth by applying selected voltages to the electrodes and the cantilever.

28. An SPM probe as recited in claim 24 further comprising:

an additional SPM tool having a cantilever and a tip on the cantilever; and

the cantilever of the additional SPM tool being connected to the base so that the additional SPM tool is located between the upper and lower surface when the cantilever is not bending, the cantilever of the additional SPM tool being capable of being selectively bent back and forth by a tip activation apparatus so as to selectively position the tip of the additional SPM tool below and above the lower surface of the base whereby the tip of the additional SPM tool may be selectively activated and deactivated for making SPM measurements of or SPM modifications to an object and protected from being damaged when deactivated.

29. A microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base such that contact displacement of the contact platform is caused when a contact force is applied to the contact platform via contact with the contact platform; and

one or more displacement actuators to apply an actuator force to the contact platform to cause actuator displacement of the contact platform with respect to the base;

wherein the contact and actuator forces are applied in opposite directions and the contact and actuator displacements occur in opposite directions.

29. A microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base, the contact platform being displaced by varying amounts of displacement when varying amounts of force are applied to the contact platform by contacting the contact platform; and

a displacement actuator to selectively apply varying amounts of force to the contact platform to selectively cause varying amounts of displacement of the contact platform with respect to the base.

30. A microstructured force balance as recited in claim 29 wherein the suspension system comprises spring arms connected to the contact platform and the base.

31. A microstructured force balance as recited in claim 29 wherein:

the suspension system displaceably suspends the contact platform over the base for displacement in multipe dimensions;

the contact force has components in the multiple dimensions so that the displacement of the contact platform is in first directions in the multiple dimensions;

the microstructured force balance further comprises multiple ones of the displacement actuator to apply the force in second directions opposite to the first directions and along the multiple axis of direction so that the actuator caused displacement

and opposite to selectively cause the varying amounts of displacement of the contact platform in the multiple directions.

31. A microstructured force balance as recited in claim 29 wherein:

the suspension system displaceably suspends the contact platform over the base in multiple directions;

the contact platform being displaced in the multiple directions by the varying amounts of displacement when the varying amounts of force are applied to the contact platform in the multiple directions by contacting the contact platform; and

the microstructured force balance further comprises multiple ones of the displacement actuator to selectively apply the varying amounts of force in the multiple directions to selectively cause the varying amounts of displacement of the contact platform in the multiple directions.

32. A microstructured force balance as recited in claim 29 that further comprises one or more displacement sensors to sense the varying amounts of displacement of the contact platform.

33. A microstructured force balance as recited in claim 32 wherein:

the suspension system displaceably suspends the contact platform over the base in multiple directions;

the contact platform being displaced by the varying amounts of displacement in the multiple directions when the varying amounts of force are applied to the contact platform in the multiple directions by contacting the contact platform;

the microstructured force balance further comprises multiple ones of the displacement actuator to selectively apply the varying amounts of force in the multiple directions to selectively cause the varying amounts of displacement of the contact platform in the multiple directions; and

the microstructured force balance further comprises multiple ones of the displacement sensor to sense the varying amounts of displacement of the contact platform in the multiple directions.

34. A microstructured force balance as recited in claim 32 that further comprises a control circuit located on the base, the control circuit being coupled to the displacement actuator to control the displacement actuator to selectively apply the varying amounts of force to the contact platform in response to displacement control signals, the control circuit being coupled to the displacement sensor to generate displacement measurement signals that provide a measure of the varying amounts of displacement of the contact platform sensed by the displacement sensor.

35. A microstructured force balance as recited in claim 29 wherein:

the contact platform comprises a displaceable electrode that is displaced when the contact platform is displaced; and

the displacement actuator comprises the displaceable electrode and a stationary electrode fixedly coupled to the base such that the varying amounts of force selectively applied to the contact platform by the displacement actuator are applied by selectively applying voltages across the stationary and displaceable electrodes.

36. A microstructured force balance as recited in claim 32 wherein:

the contact platform comprises a displaceable electrode that is displaced when the contact platform is displaced; and

the displacement sensor comprises the displaceable electrode and a stationary electrode fixedly coupled to the base such that the varying amounts of displacement of the contact platform are sensed by sensing voltage changes across the stationary and displaceable electrodes.

37. A microstructured force balance as recited in claim 29 wherein:

the contact platform comprises a displaceable comb structure that is displaced when the contact platform is displaced;

the displacement actuator comprises the displaceable comb structure and a stationary comb structure fixedly coupled to the base such that the varying amounts of force selectively applied to the contact platform by the displacement actuator are applied by selectively applying voltages across the stationary and displaceable comb structures.

38. A microstructured force balance as recited in claim 32 wherein:

the contact platform comprises a displaceable comb structure that is displaced when the contact platform is displaced; and

the displacement sensor comprises the displaceable comb structure and a stationary comb structure fixedly coupled to the base such that the varying amounts of displacement of the contact platform are sensed by sensing voltage changes across the stationary and displaceable comb structures.

39. A force measurement system to measure a force applied by an item with respect to displacement of the item, the force measurement system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base, the displacment of the item causing the force that causes a first displacement of the contact platform that is applied to the contact platform by an item while the item contacts the contact platform; and

a displacement actuator to apply a force to the contact platform to cause a second displacement of the contact platform with respect to the base;

system components to measure the force applied by the item by (a) causing the displacement actuator to apply the force to the contact platform to cause the second displacement of the contact platform, (b) measuring the first and second displacements and determining when the first displacement has been nulled by the second displacement, and (c) measuring the force applied by the displacement actuator when the first displacement has been determined to have been nulled by the second displacement.

39. A force measurement system to measure a force applied to an item with respect to displacement of the item and/or the displacement of the item with respect to the force applied to the item, the system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base; and

a displacement actuator to apply a force to the contact platform to cause the displacement of the contact platform with respect to the base;

system components (a) cause the displacement actuator to apply the force to the contact platform that cause the displacement of the contact platform, and (b) measure the force applied to the item with respect to the displacement of the item and/or the displacement of the item with respect to the force applied to the item.

39. A force measurement system to measure a contact force applied by an item, the force measurement system comprises:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base such that contact displacement of the contact platform is caused when the contact force is applied by the item to the contact platform via contact with the contact platform; and

one or more displacement actuators to apply an actuator force to the contact platform to cause actuator displacement of the contact platform with respect to the base;

the contact and actuator forces being applied in opposite directions and the contact and actuator displacements occuring in opposite directions;

system components to measure the contact force by (a) causing the one or more displacement actuators to apply the actuator force to the contact platform, (b) and (b) measuring the actuator force when the contact displacement is nulled by the actuator displacement.

39. A force measurement system to measure a force applied to an item, the force measurement system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base such that a force that causes a first displacement of the contact platform is applied to the contact platform by an item while the item contacts the contact platform; and

a displacement actuator to apply a force to the contact platform to cause a second displacement of the contact platform with respect to the base;

system components to measure the force applied to an item by (a) causing the displacement actuator to apply the force to the contact platform to cause the second displacement of the contact platform, (b) measuring the first and second displacements and determining when the first displacement has been nulled by the second displacement, and (c) measuring the force applied by the displacement actuator when the first displacement has been determined to have been nulled by the second displacement.

39. A system to measure displacement of an item with respect to a known force applied to the item, the system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base; and

a displacement actuator to apply a known force to the contact platform to cause displacement of the contact platform with respect to the base which causes the displacement of the item when the item is in contact with the contact platform; and

system components to (a) cause the displacement actuator to apply the known force to the contact platform and (b) measure the displacement of the item.

39. A system to measure a force applied to an item with respect to displacement of the item, the system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base; and

a displacement actuator to apply a force to the contact platform to cause displacement of the contact platform with respect to the base which causes the displacement of the item when the item is in contact with the contact platform; and

system components to (a) cause the displacement actuator to apply the force to the contact platform, (b) measure the force, and (c) measure the displacement of the item.

39. An SPM system to make SPM measurements of or SPM modifications to an object, the SPM system comprising:

an SPM probe with a cantilver and a tip on the cantilever;

a positioning system to position the SPM probe;

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base; and

a displacement actuator to apply a force to the contact platform to cause displacement of the contact platform with respect to the base;

positioning the the contact platform such that a force that causes displacement of the contact platform is applied to the contact platform by the SPM probe while the SPM probe contacts the contact platform

that nulls the displacement of the contact platform caused by the force applied by the item

system components to measure the force applied by the item to the contact platform by (a) causing the displacement actuator to apply the force to the contact platform to cause the displacement of the contact platform and (b) measuring when the displacement caused by the force applied by the item has been nulled by the displacement caused by the force applied by the displacement actuator.

36. A microstructured force balance as recited in claim 35 wherein the moveable platform includes an obdurate contact plate on which contact is made in order to displace the moveable platform.

37. A microstructured force balance as recited in claim 36 wherein the moveable electrode comprises the obdurate contact plate.

38. A microstructured force balance as recited in claim 36 wherein the moveable electrode comprises conductive diamond.

39. A microstructured force balance as recited in claim 36 wherein the moveable electrode comprises conductive silicon carbide.

40. A microstructured force balance as recited in claim 36 wherein the moveable electrode comprises conductive diamond like carbon.

41. A microstructured force balance as recited in claim 36 wherein the moveable electrode comprises conductive carbon nitride.

42. A microstructured force balance as recited in claim 30 wherein:

the moveable platform comprises a moveable electrode; and

the one or more displacement actuators comprise a displacement actuator that comprises the moveable electrode and a first stationary electrode fixedly coupled to the base such that the varying amounts of displacement of the moveable platform are selectively caused by applying selected voltages across the stationary electrode and the moveable electrode;

the one or more displacement sensors comprise a displacement sensor that comprises the moveable electrode and a second stationary electrode fixedly coupled to the base such that the varying amounts of displacement of the moveable platform are sensed by detecting voltage changes across the stationary electrode and the moveable electrode.

43. A microstructured force balance as recited in claim 29 wherein:

the moveable platform comprises a moveable comb structure;

the one or more displacement actuators comprise a displacment actuator that comprises a moveable comb structure electrode and a stationary electrode fixedly coupled to the base such that the varying amounts of displacement of the moveable platform are selectively caused by applying selected voltages across the stationary electrode and the moveable electrode;.

39. A force measurement system to measure a force applied to or by an item, the force measurement system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base such that a force that causes displacement of the contact platform is applied to the contact platform by an item while the item contacts the contact platform; and

a displacement actuator to apply a force to the contact platform to cause displacement of the contact platform with respect to the base that nulls the displacement of the contact platform caused by the force applied by the item;

system components to measure the force applied by the item to the contact platform by (a) causing the displacement actuator to apply the force to the contact platform to cause the displacement of the contact platform and (b) measuring when the displacement caused by the force applied by the item has been nulled by the displacement caused by the force applied by the displacement actuator.

39. A force measurement system to measure a force applied to or by an item, the force measurement system comprising:

a microstructured force balance that comprises:

a base;

a contact platform;

a suspension system connected to the base and the contact platform to displaceably suspend the contact platform over the base such that a force that causes displacement of the contact platform is applied to the contact platform by an item while the item contacts the contact platform; and

a displacement actuator to apply a force to the contact platform to cause displacement of the contact platform with respect to the base that nulls the displacement of the contact platform caused by the force applied by the item;

system components to measure the force applied by the item to the contact platform by (a) causing the displacement actuator to apply the force to the contact platform to cause the displacement of the contact platform and (b) measuring when the displacement caused by the force applied by the item has been nulled by the displacement caused by the force applied by the displacement actuator.

31. A nanostructured force balance as recited in claim 29 wherein the moveable platform includes an obdurate contact plate for making contact in order to displace the moveable platform.

32. A nanostructured force balance as recited in claim 31 wherein the moveable plate electrode is the obdurate contact plate.

33. A nanostructured force balance as recited in claim 32 wherein the moveable plate electrode comprises conductive diamond.

34. A nanostructured force balance as recited in claim 32 wherein the moveable plate electrode comprises conductive silicon carbide.

35. A nanostructured force balance as recited in claim 32 wherein the moveable plate electrode comprises conductive diamond like carbon.

36. A nanostructured force balance as recited in claim 32 wherein the moveable plate electrode comprises conductive carbon nitride.

29. An SPM system that comprises:

an SPM probe comprising:

a base with an aperture therein;

an SPM tool connected to the base and located within the aperture;

components to make an SPM measurement of or SPM modification to the object with the SPM tool of the SPM probe; and

a vacuum source in fluid communication with the aperture in the base of the SPM probe;

the components including a positioning system to position the probe with respect to the object to maintain a gap between the object and the lower surface of the probe so that the vacuum source causes a vacuum to be established in the gap while the SPM measurement of or SPM modification to the object is made with the SPM tool of the SPM probe.

1. A probe for delivering a fluid material to an object, the probe comprising:

a tip with a capillary;

a microstructured pump having an inlet to receive the fluid material and an outlet in fluid communication with the capillary, the pump pumping the fluid material into the capillary so that the fluid material is ejected by the capillary and delivered to the object in response to a control signal received by the pump.

2. A probe as recited in claim 1 further comprising:

a base in which the pump is formed; and

a support platform connected to the base and on which the tip is located, the support structure having a duct that connects the capillary of the tip and the outlet of the pump.